The Effects of Temperature on Zebrafish Exposed to Ultraviolet Radiation

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Does temperature increase the effects of ultraviolet radiation exposure on zebrafish eye?

*Ozone depletion and global warming are two of the greatest environmental concerns that humanity faces in our time. The ozone layer provides a shield for all forms of life on earth by filtering the amount of ultraviolet (UV) radiation emitted from the sun.

*UV radiation at the higher level of the electromagnetic spectrum is a form of ionizing radiation that can cause macular degeneration, corneal cataracts, and also some forms of cancer in humans and animals.

*In this study, we chose wild-type zebrafish as the model to conduct our experiments in favor of their abundant availability, and simple care protocols. The main purpose of our research is to test if high temperatures intensify UV radiation's effect on the morphological development of zebrafish eyes.

PURPOSE

Past Studies

- Not much has been done in the way of studying how it may affect everyday activities if used over long periods of time. There is no clear consensus on whether multi-tasking has a positive impact on a person's ability to focus or whether it can enhance one's experiences.

Environment

- Another major environmental concern is global warming, which is the gradual rise of earth's temperatures caused by the increase of atmospheric greenhouse gases like carbon dioxide and methane that trap heat inside the earth's atmosphere.

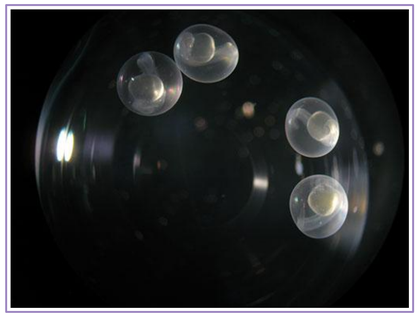
Hypothesis

- We conducted the experiment with the hypothesis that increasing the temperatures of embryo water will intensify the effects of ultraviolet light radiation on zebrafish eye size.

METHODS

Fish Type (Figure 3.) → Housing and Care (Figure 1.) → Exposure Set-Up → Preliminary Experiment 1 → Preliminary Experiment 2 → Eye Measurement (Figure 2.)

Figure 1.

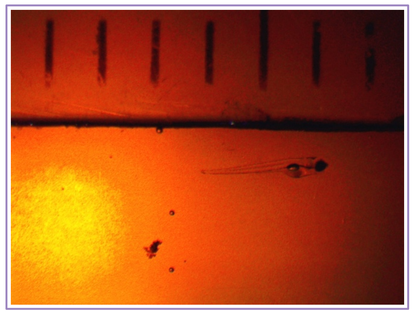


Wild type zebrafish (*Danio rerio*) embryos were used in this study.

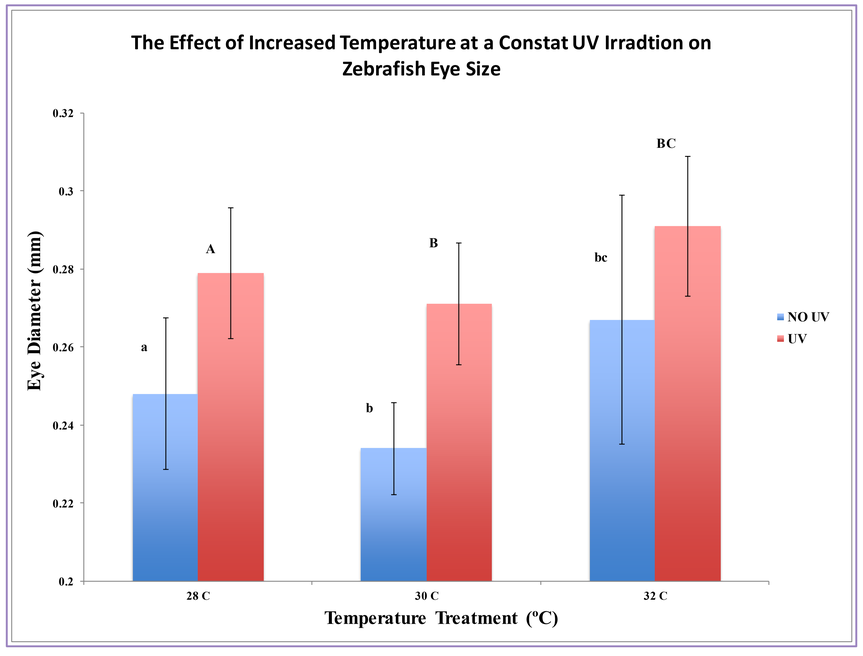
Figure 3.

Figure 4.

Figure 2.



Here is an image taken using AmScope and ImageJ was used to obtain measurements (mm).



*We exposed a larger sample of 21 zebrafish to UV-B Radiation of (3500 µJ/cm^2) at (28 ° C, 30 °C and 32 ° C) and we also had a control with no exposure at the same temperatures.

REFERENCE

Seebacher F, Kazerouni EG, Franklin CE. 2016 *Ultraviolet B radiation alters movement and thermal selection of zebrafish* (Danio rerio). Biol. Lett.

RESULTS

Preliminary Experiment 1

"Sweet spot" is between 3,000-4,000 µJ/cm^2 (3500 µJ/cm^2)

Preliminary Experiment 2

No significant main effect of the temp changing eye size $F(2,12)=1.539$, $p<.05$	Significant main effect of the no UV – UV changing eye size $F(1,12)=.490$, $p=.497$	Significant main effect within temp (noUV – UV) changing eye size $F(2,12)=6.025$, $p<.05$

*Main Experiment (Figure 4.)

Significant main effect of the temp changing eye size $F(2,36)=7.830$, $p<.05$	Significant main effect of the no UV – UV changing eye size $F(1,36)=18.697$, $p=.000$	Significant main effect within temp (noUV - UV) changing eye size $F(2,12)=.161$, $p<.05$

DISCUSSION AND FURTHER RESEARCH

*Our hypothesis stated that increasing temperatures of embryo water would intensify the effects of ultraviolet radiation on zebrafish eye size, but our results refute our hypothesis.

*Temperature and ultraviolet light radiation are completely independent of each other in terms of eye size. Our results are evidence that increasing temperatures increased eye size, and the presence of ultraviolet light also increased eye size.

*However, our results show a dip in the increasing pattern at 30° C, we believe that this is due to 30° C being the optimal temperature in terms of eye size.

*Further research could explain this phenomenon and could also examine the possible implications to other parts of mammalian bodies.